ALIGNMENT AND ADJUSTMENTS - COMMENTS

The "VideoBeam" Model 1000A is a high performance television system which is, because of its uniqueness, quite vulnerable to misadjustments. The impact of size, color and brightness to the untrained eye can give the impression that the set is performing properly, whereas the quality of the picture may be significantly below 1000A standards. Accordingly, no adjustment should be attempted unless the serviceman knows what to look for upon making the adjustment.

If an adjustment is to be attempted, a general rule of thumb is to always note the initial setting of the control, make small adjustments about that point, and, if improvement is not obtained, return the control to its original setting. Some controls will have minimal effect under certain conditions (such as poor video, weak signal, etc.) and if a misadjustment is then made under these conditions (because "it doesn't make any difference"), the performance of the set will be sub-standard upon receiving other types of signals.

Thus, every adjustment, from screen-projector alignment to convergence, should be regarded as critical in that if an improper adjustment is made, the overall performance of the system will be degraded.

NOTES

1. All references to rotation are with respect to the front of the pot (side with the moveable plastic piece).

2. Most replacement boards (with the primary exceptions being 2400, 2500, and 2600, which are set for zero correction) have been aligned in test jigs. Thus most adjustments are satisfactorily set.

3. The following controls are factory sealed (with epoxy) such that no adjustment can be made without destruction of the control: high voltage adjust (horizontal output board); anode over-voltage trip point (horizontal oscillator board); brightness limiter adjust (RGB processor board); G1 adjustments (kick panel); and AGC control (kick panel). Accordingly, if an adjustment of one of these controls is required (if, for instance, the high voltage cage is replaced), the pot must be replaced before the adjustment is attempted and then sealed when the adjustment is complete.

Control	Advent Part No.	Description
High Voltage	50-714-040	Trim Pot, 250K, linear
Anode Over-voltage	50-714-009	Trim Pot, 25K, linear
Brightness Limiter	50-714-018	Trim Pot, 5K, linear
Individual GI's	50-714-058	Pot, 1 Meg, linear
AGC	50-714-056	Pot, 1K, linear
For the kick panel controls (GI's and AGC), the following "pot cap" must be installed (and sealed) over the pot adjustment.		
	60-532-007	Pot cap, black

4. Three test points on a terminal strip beside the Vertical Amplifier output transistors (QA 101, QA 102) on the chassis door provide horizontal, vertical, and sync pulse timing for external triggering of oscilloscopes.

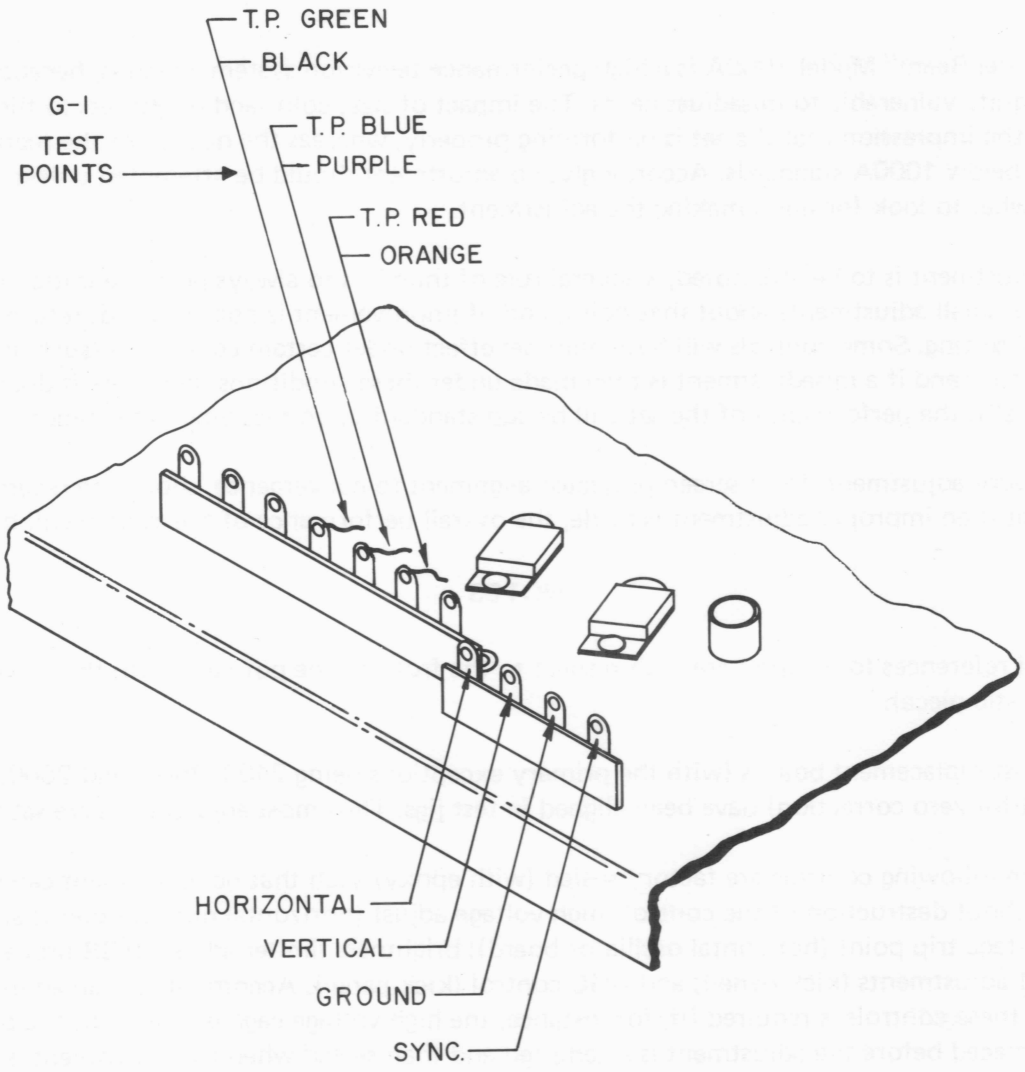


Figure 7-1. PC BOARD ADJUSTMENTS

100 15 Volt/30 Volt regulator

R15 - 15 Volt output. Adjust for 15 $\pm$0.1 Volts

R32 - 30 Volt output. Adjust for 30 $\pm$0.1 Volts

300 RF/IF Alignment: Realignment of the UHF/VHF tuners, IF strip and AFT is not recommended.

The type of alignment generators generally used in TV repair are not sufficiently accurate (in terms of frequency response, stability, etc.) to assure the level of performance necessary for proper operation of the VideoBeam 1000A. If misalignment of these sections is suspected, it is important to verify the suspicion, by checking the antenna on a TV receiver of known performance, checking the VideoBeam with a direct video input, or feeding the video output of the VideoBeam to a studio monitor. If the RF/IF sections are still thought to be operating improperly, contact Advent about a replacement section, which must include a new AGC/IF processor board (400).

400 AGC/IF Processor

R35 - RF AGC delay. This control should not normally be adjusted. However, if a situation exists such that two strong adjacent channels are cross-modulating, then the pot can be rotated slightly.

NOTE

THE PENALTY FOR THIS ADJUSTMENT IS INCREASED NOISE ON ALL CHANNELS - THUS IT IS IMPORTANT TO VERIFY THAT THE CROSS-MODULATION IS NOT ON THE ANTENNA SYSTEM. (THE POT CAN BE RETURNED TO ITS ORIGINAL SETTING BY MONITORING THE RF AGC WITH A HIGH IMPEDANCE METER.)

R13 - phase correction. Do not adjust.

R18 - external video level. Set for 1V p-p terminated or 2V p-p unterminated, at Video Out connector.

500 Audio Demodulator

L1 - detector tank frequency. Adjust for a combination of maximum recovered audio and also minimum sync buzz.

800 External Video Amplifier

R18 - gain. Set so that with a 1V p-p input to the board (TP 1) the output is 3V p-p (TP 4).

900 Comb Filter

R45, R58, R64, C8. These interdependent controls are adjusted such that: a) for a pure luminance signal (i.e., Multiburst) the chrominance output is as small as possible; and b) there is as little as possible chrominance in the luminance output. See waveform 6. Part "b" can be verified with off-the-air video by checking that the color burst is nulled out of the luminance at TP 14.

R56 - chrominance level. With a saturated NTSC Color Bar signal adjust for 1V p-p of signal at pin 12.

1100 Chroma System

R37 - Automatic Phase Control (APC). Disconnect P2/J2. Bring the Color Killer control CW until bands of color appear on the screen. Adjust R37 until the bands slow down or stop. Connect P2/J2. Reset the Color Killer.

R36 - Automatic Color Control (ACC). Adjust for 300 mV p-p of chroma signal at TP 4 with a Color Bar signal input and the color control midrange.

NOTE

IF EITHER OF THESE CONTROLS IS ADJUSTED, CHROMA LOCK-UP SHOULD BE CHECKED BY CHANGING CHANNELS AND SWITCHING BETWEEN "NORMAL" AND "EXTERNAL". IF LOCK-UP IS POOR RETWEAK R36 CCW.

1200 NTSC Decoder

For the following adjustments an accurate NTSC color bar signal is required. Midrange Tint and Color controls.

C4 - 3.58 MHz reference phase shift. Adjust for no I signal in the Q signal (TP 2), and no Q signal in the I signal (TP 6). This is accomplished by using a split field color bar signal containing I and Q. See waveform 16.

R46 - Blue phase and amplitude. Adjust for correct B signal at TP 16. See waveform 18.

R36, R38 - Red phase, Red amplitude. Adjust for correct R signal at TP 15. See waveform 17.

R54, R55 - Green phase, Green amplitude. Adjust for correct G signal at TP 17. See waveform 19.

1300 RGB Processor

R19, R39, R59 - G,B, and R drive. See Gray Scale Tracking section.

R81 - anode current limit. See note 3 at beginning of this section. Adjust such that the anode current is limited to 600 μA with very bright scenes (use a flat white field test pattern or the brightest video available with full brightness and contrast). Anode current can be measured by connecting a 1 ma current meter across the Anode Current Measurement Test Points (see "Anode Current Measurements" in Service Aids Section).

1500 Cross-Hatch Generator

R18 - vertical line spacing. Make the vertical line spacing slightly larger than the horizontal line spacing.

1600 Vertical Oscillator and Amplifier

R16 - vertical linearity. Adjust for maximum linearity in the vertical yoke current (a current probe with response to DC is required for an accurate adjustment). Alternatively, visually adjust for maximum vertical linearity of the crosshatch pattern.

1700 Horizontal Oscillator

R15 - Horizontal hold limit. Adjust so that the front panel Horizontal Hold control has maximum symmetry of operation.

L3 - Horizontal oscillator coil. Adjust so that the waveform at TP 7 matches that shown in the circuit description (Figure 1700-1).

R21 - anode overvoltage shutdown. See note 3 at the beginning of this section. Accurate high voltage measurement is required here.* The control is adjusted so that the set will not shut down at 32 KV and will definitely shut down before 32.5 KV. Set R21 fully counterclockwise, adjust R23, board 1800, for a high voltage of 32 KV, remove jumper "P1" and then slowly turn R21 clockwise until the high voltage turns off. Reset the circuit by turning the set off and pulling board 1700, restoring the jumper to the pin and reinserting the board. Turn the set on, and by varying the high voltage with R23, board 1800, check that the high voltage does not kick off at 32.0 KV and does by 32.5 KV (wait at least one minute at both the 32.0 KV and 32.5 KV settings); if not, make the appropriate readjustment. (Be sure to readjust R23 on 1800 for 30 KV.)

*If an accurate high voltage meter is not available, use a DVM to measure the voltage on R22 (56K). The reading here is directly proportional to the high voltage, so the original reading corresponds to 30 KV, and 32 KV and 32.5 KV correspond to that reading plus 6% and 8% respectively.

1800 Horizontal Output

R23 - anode voltage. See note 3 at the beginning of this section. Adjust for 30 KV $\pm$100V at 117V line.

2200 G2 Doubler and Regulator

R3 - 2 nd grid voltage. With a high impedance ($>$ 100 Meg Ω) meter adjust R3 for 825 $\pm$5V at TP 4.

NOTE

AN INSULATED SCREWDRIVER SHOULD BE USED FOR THIS ADJUSTMENT.

2400,
2500, &
2600 See Convergence section.

2700 Scan Failure Protection

R7, R23 - G1 turn-off point, vertical and horizontal circuits respectively. With the vertical hold control adjusted for minimum height, rotate each pot in turn CCW until the picture is blanked off, and then CW until the picture appears. Leave each one slightly CW of this point.

MAIN CHASSIS (KICK PANEL) CONTROLS

Master Width - LA 103

See the convergence procedure in this section. (Adjustment should result in a total horizontal yoke current of approximately 8A p-p.

Master Height - RA 163

See the convergence procedure in this section. (Adjustment should result in a vertical yoke current of approximately 0.8A p-p.)

Color Killer - RA 109

The preferred procedure is to adjust for no color with a known monochrome program (plus slightly CW). Alternatively, adjust for no color in "snow" on a blank channel.

R,B,G,G1 - RA 113, RA 114, RA 115

These are coarse screen adjustments and should not normally need to be changed from the factory position. See note 3 at the beginning of this section.

Δ High Voltage - RA 120

Adjusts anode voltage ±600V. Set for optimum focus control action. (Best focus when all focus pots close to mid-rotation.)

AGC - RA 106

Factory adjusted for 3V p-p of video at Comb Filter (900) pin 1. See note 3 at the beginning of this section.

GRAY SCALE TRACKING ADJUSTMENTS

Gray scale tracking adjustments are made with the screen controls and the drive controls. The screen controls are adjusted so that all three tubes are "cut-off" simultaneously with the brightness control mid-range; this results in gray backgrounds or low-lites and also insures that the optimum brightness setting is midrange. The drive controls are then adjusted for optimum gray scale tracking from dark to bright scenes.

SCREEN CONTROLS*:

Switch the service-normal switch to service, mid-range the brightness control, turn all three tubes on, then adjust each screen control for a barely visible band of the corresponding color. After all three screens have been adjusted, a faint gray band should be visible on the screen. Adjust in as dark an environment as possible.

DRIVE CONTROLS:

Return the service-normal switch to normal, tune to a good off-the-air picture, and turn the color control fully down. Now vary picture brightness with the contrast control and check that the picture remains gray at all brightness levels. If not, make appropriate adjustments with the drive controls until this is so.

WARNING

AN EFFORT MUST BE MADE HERE TO MAINTAIN THE AVERAGE LEVEL OF THE THREE DRIVE CONTROLS.** IF THE MEAN LEVEL OF THE THREE DRIVES IS ADJUSTED DOWN, PEAK BRIGHTNESS WILL BE LOWERED, AND IF ADJUSTED UP THE VIDEO CLIPPERS WILL DISTORT HIGHLIGHTS IN BRIGHT SCENES.

*The G1 kick panel controls are coarse screen controls and are factory set for 70 volts. These are capped and sealed so field adjustment should not be necessary.

**The drive controls are nominally set so that there is 45 volts at the video outputs from black level (contrast control fully down) to peak white level (contrast control fully up, as measured to peak whites which are available in VITS information). Gray scale tracking adjustments usually require drive control adjustments beyond this nominal setting to compensate for varying characteristics of the electron gun assemblies. Proper peak brightness levels are obtained when the average of the three drive settings is roughly the nominal 45 volts from black level to peak white level.

CONVERGENCE

COMMENTS AND SUGGESTIONS ON CONVERGENCE

1. Convergence "Touch-Ups"

With the passage of time or due to rough handling during shipment, the dynamic convergence of the "VideoBeam" may change slightly. The versatility and independence of the Advent controls allow for rapid "touch-up", provided the serviceman has a good understanding of the corrections employed in the set. These corrections are for individual red, green and blue height, width, linearity, skew, bow and keystone.

In a full convergence or a "touch-up", it is best to look at only two colors at once; compare their horizontal lines by temporarily offsetting the two images vertically by roughly the width of a line (using DC Positioning Controls) and make corrections as required (see chart below), then compare vertical lines similarly and again make the required corrections.

The order in which corrections are made is not critical due to the independence of the controls; however, since yoke rotation will affect vertical as well as horizontal lines, any necessary yoke rotation should be done first. Also, always keep in mind that there are three tubes, so if mis-convergence exists, try to determine the two colors that do match and then adjust the third tube to match these.

Lines that Fail To Match	Corrections Available		
	Red	**Blue**	**Green**
1) Central Horizontal Lines	Yoke Rotation	Yoke Rotation	Yoke Rotation
	—	Blue Vertical Bow	Green Vertical Bow
2) Top and Bottom Horizontal Lines (If the Central Horizontal Lines match)	Red Height	Blue Height	Green Height
	Red Vertical Keystone	—	Green Vertical Keystone
	—	Blue Vertical Linearity	Green Vertical Linearity
3) Central Vertical Lines	Red Skew	Blue Skew	Green Skew
	Red Horizontal Bow	Blue Horizontal Bow	Green Horizontal Bow
4) Left and Right Vertical Lines (If the Central Vertical Lines match)	Red Width	Blue Width	Green Width
	Red Horizontal Linearity	Blue Horizontal Linearity	Green Horizontal Linearity
	Red Horizontal Keystone	Blue Horizontal Keystone	Green Horizontal Keystone

2. Advent Versus The Conventional Set

   Do not confuse Advent convergence controls with those of a direct view set or try to draw analogies. Other than the individual width coils, all controls are truly independent (no interaction of red controls with green, etc.) and act only in one direction (affecting only horizontal or vertical lines, never both).

3. Convergence Upon Tube Replacement

   The reconvergence of a set after a tube has been replaced may be considered a situation requiring convergence "touch-up" (rather than total reconvergence) since the two original tubes will be converged and the new tube will have nominal corrections (those that were present for the replaced tube). Thus, one has only to "touch-up" the new tube to match it to one of the original tubes.

4. Convergence Priorities

   Always keep in mind that blue is the *least* important color to the overall picture quality; accordingly, it may be advantageous to sacrifice some blue convergence accuracy if red-to-green convergence can be improved.

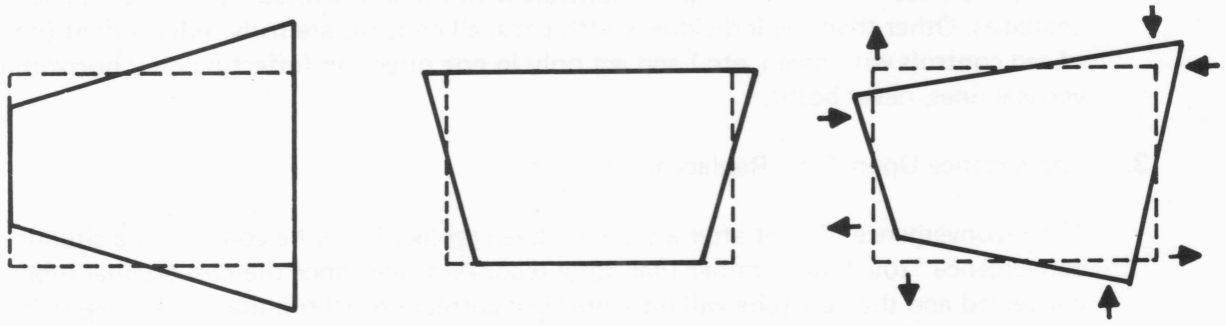
DESCRIPTION OF CONVERGENCE REQUIREMENTS

The design of the Advent VideoBeam requires corrections for convergence which are necessarily different from a typical direct view television set. First, three separate tubes require three separate yokes; therefore corrections must be present for horizontal and vertical positions, sizes, linearities, as well as for the orthogonalities (skew) of horizontal and vertical sections of each individual yoke. Second, screen-projector geometry necessitates two additional types of corrections: keystone and bow.

Keystone corrections are required because the individual tubes project from different angles. A tube projecting a perfect rectangle from the left (as the red tube does) will produce at the screen a trapezoid which is "short" along the left edge and "tall" along the right edge. This is known as red vertical keystoning. Similar keystone effects exist for the other tube/projection axis combinations (See Figure 7-2).

Bow is caused by a plane of light obliquely striking a curved screen. Thus, a red vertical line at the screen center will be bowed to the right (the red tube being angled at the screen from the left): this is known as horizontal bow. Similar bows occur for other tube/projection axis combinations (See Figure 7-3). Note that there is no blue horizontal bow or blue vertical keystone since this tube projects along the vertical plane normal to the screen center.

EXAMPLE OF KEYSTONE (EXAGGERATED) (Figure 7-2)



A

Vertical Keystone
(tube projecting rectangle from left)

B

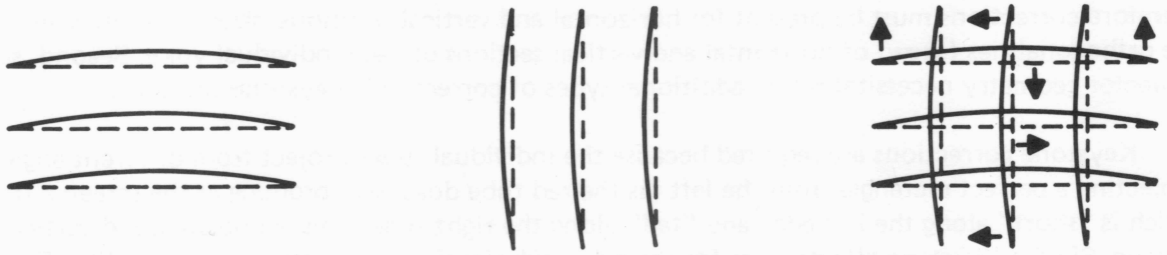
Horizontal Keystone
(tube projecting rectangle from below)

C

Resultant Keystone effect for the red tube (projecting rectangle from left *and* below)

The horizontal arrows indicate the electronic corrections applied for Horizontal Keystone, and the vertical arrows similarly for Vertical Keystone.

EXAMPLE OF BOW (EXAGGERATED) (Figure 7-3)



A

Vertical Bow
(tube projecting horizontal lines at curved screen from below)

B

Horizontal Bow
(tube projecting vertical lines at curved screen from right)

C

Resultant Bow Effect for the Green Tube (projecting horizontal and vertical lines at curved screen from below *and* right)

The horizontal arrows indicate the electronic corrections applied for horizontal bow, and the vertical arrows indicate similarly for vertical bow.

CONVERGENCE CONTROL LOCATIONS

Top Panel Controls:

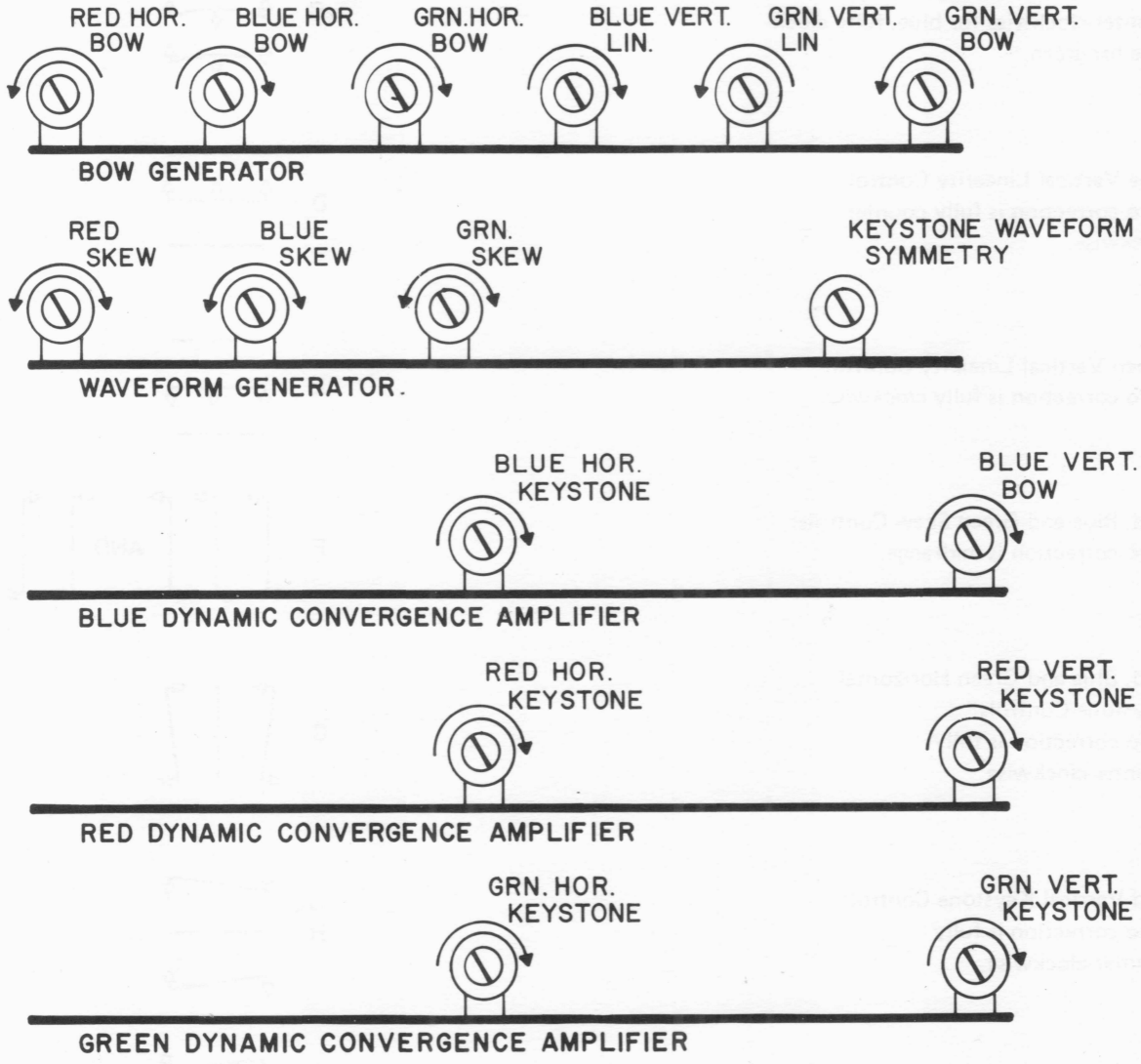
Individual height, width and horizontal linearity controls are located under the cover plate and are labeled.

Kick Panel Controls:

Master width and master height controls are located on the kick panel.

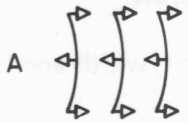
Door Controls: (Bottom right corner of door)

The configuration of controls on the convergence boards is as follows: (Arrows indicate rotation required for more correction).

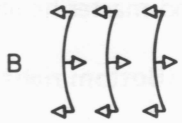


ACTIONS OF DOOR CONVERGENCE CONTROLS (Figure 7-5)

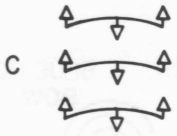
A. Red and Blue Horizontal Bow Control: Zero correction is fully counter-clockwise for blue, fully clockwise for red.



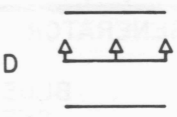
B. Green Horizontal Bow Control: Zero correction is fully counter-clockwise.



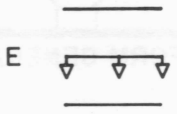
C. Green and Blue Vertical Bow Controls: Zero correction is fully counter-clockwise for blue, fully clockwise for green.



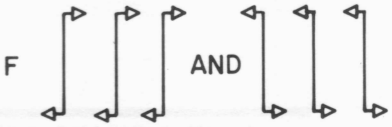
D. Blue Vertical Linearity Control: Zero correction is fully counter-clockwise.



E. Green Vertical Linearity Control: Zero correction is fully *clockwise.*

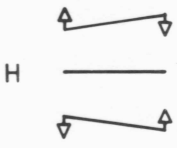


F. Red, Blue and Green Skew Controls: Zero correction is midrange.

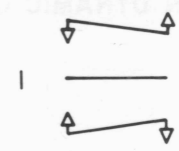


G. Red, Blue and Green Horizontal Keystone Controls: Zero correction is fully counter-clockwise.

H. Red Vertical Keystone Control: Zero correction is fully counter-clockwise.



I. Green Vertical Keystone Control: Zero correction is fully counter-clockwise.



ASCERTAINING PROPER FUNCTIONING OF CONVERGENCE CONTROLS

Top Panel Controls

1. The DC Positioning Controls should deflect the pattern of the appropriate color over a range of roughly 6 inches (±3 inches) in the direction indicated on the panel.

2. Each individual height control should vary the scanning height of the appropriate color over a range of roughly 3 inches (±1½ inches).

3. Each individual width control should vary the width of the appropriate color over a range of several inches. Note that as the width of one color is changed, the widths of the other two colors will change in the opposite sense (i.e., larger-smaller or smaller-larger); this is normal.

4. Each individual horizontal linearity control should shift the pattern center of the appropriate color to the right by roughly one inch while having minimal effect on the far left of the pattern. Zero correction is full counter-clockwise rotation of the pots.

Door Controls

To test these controls, switch the VideoBeam to the internally generated cross-hatch pattern and compare the effect of each control to the motion indicated in the appropriate diagram. (Figure 7-5). Note that only the lines affected (horizontal or vertical) are shown in the diagrams.

CONVERGENCE PROCEDURE

Preliminaries:

1. Initial Settings of Top Panel Controls:
   Individual Height Controls - Midrange
   Horizontal Linearity Controls - Fully counter-clockwise
   Individual Width Controls - Slugs near coil center
   All DC Positioning Controls - Midrange

2. Initial Settings of Door Controls:
   Red Horizontal Bow Control - Fully clockwise
   Blue Horizontal Bow Control - Fully counter-clockwise
   Green Horizontal Bow Control - Fully counter-clockwise
   Blue Vertical Linearity Control - Fully counter-clockwise
   Green Vertical Linearity Control - Fully clockwise
   Green Vertical Bow Control - Fully clockwise

   Red, Blue and Green Skew Controls - Midrange

   Keystone Waveform Symmetry Control - This control is set so that the horizontal keystone controls have no effect on the center vertical lines of their respective colors. To ascertain this, turn only the blue tube on with the symmetry control and midrange, and then repeatedly turn

the blue horizontal keystone control up and down. Note the area of the cross-hatch pattern which remains stationary; the symmetry control should vary this "non-corrected" area. The proper setting is that which leaves the center vertical line stationary.

All Controls on Dynamic Convergence Amplifier Boards - Fully counter-clockwise.

Trim Pot on pincushion board - Fully counter-clockwise, as seen from above so that no pincushion correction is present.

3. Yoke Tightening (if necessary):

With the yokes fully forward on the tubes, a *non-magnetic* screw driver, if available, should be used to tighten all yoke clamps until the yokes are snug, but rotatable with a firm twist of the hand. *If a steel screw driver must be used, care should be taken to avoid touching the focus magnet assemblies.* Deterioration of the quality of focus could result otherwise.

4. Screen Projector Alignment:

The projector must be carefully aligned to the screen for optimum focus and convergence. Attach the screen-projector alignment cord ends to the appropriate pins behind the lower screen corners (See Figure 2-5), extend the cord fully to the floor in front of the screen and mark the location where the cord knot falls. Remove the cord and place the front projector foot at this location. In all subsequent steps be sure that this foot remains on its mark. Turn the set on and turn to a snowy "non-station". By pivoting the projector about its front foot, note the left and right extremities of the projected "snow". By raising and lowering the rear projector feet (screwing them in an out to vary their heights), note the top and bottom extremities of this "snow". Insure that the observed boundaries are *not* scanning limits, but geometrical limits imposed by the tubes, by adjusting the master height and master width controls until these controls have no effect on the boundaries. Also note that for any one of these extremities "three color" snow may turn to "one or two color" snow at the very edge (this is dependent on the individual tube geometry and is normal).

Having ascertained all four boundaries of the "three color" snow pattern, make these boundaries extend over all four edges in equal amounts by pivoting the projector about its front foot and adjusting the heights of the individual feet. To accomplish this, the screen sample (or a white piece of paper, with the room darkened) can be employed as a "screen extension" by holding it along any screen edge parallel to the screen surface. In this manner, one can ascertain when the "three color" snow pattern symmetrically overlaps the screen.

NOTE

IN THE FOLLOWING CONVERGENCE PROCEDURE, MAKE FREE USE OF THE BLUE AND GREEN DC POSITIONING CONTROLS WHILE MAKING CONVERGENCE ADJUSTMENTS (THE RED CONTROLS ARE SET ONLY ONCE AND THEN THE RED IMAGE SERVES AS A REFERENCE TO CENTER THE BLUE AND GREEN IMAGES). IN GENERAL, WHEN MATCHING CORRESPONDING LINES OF TWO DIFFERENT COLORS, IT HAS BEEN FOUND MOST CONVENIENT TO OFF-SET ONE IMAGE FROM THE OTHER BY APPROXIMATELY THE WIDTH OF A LINE. EXCEPT FOR STEP NO. 1, A CROSS-HATCH PATTERN SHOULD BE USED FOR THIS ENTIRE PROCEDURE.

WARNING

IN THE FOLLOWING STEPS BE CAREFUL NOT TO TOUCH ANY ELECTRICAL CONNECTION OR HIGH VOLTAGE LEADS - DANGEROUS VOLTAGES ARE PRESENT.

Procedure

1. Blue tube on: (use off the air video for this step)

   a. Adjust the vertical hold and/or master height controls and the master width control until the picture height and width is roughly 2 inches short of the screen height and width.

   b. Center the picture on the screen using Blue DC Positioning controls.

   c. Carefully rotate the Blue yoke until the top and bottom horizontal lines are parallel to the top and bottom screen edges.

2. Red and Blue tubes on: (use test pattern from here to end of procedure)

   a. Converge red to blue at the screen center by using the red DC Positioning controls. These controls are now properly set and should not be moved in any subsequent step.

   b. Carefully rotate the red yoke until the red center horizontal line is parallel to the blue center horizontal line.

3. Blue and Green tubes on:

   a. Converge green to blue at the screen center by using the green DC Positioning controls.

   b. Carefully rotate the green yoke until the green center horizontal line is parallel to the blue center horizontal line.

4. Red, Blue and Green tubes on:

   a. Ascertain the colors with the maximum and minimum vertical scanning heights, and then adjust the individual height controls so that all colors have a common height midway between these maximum and minimum heights.

   b. Ascertain the colors with the maximum and minimum horizontal scanning widths, and then adjust the individual width controls so that all colors have a common width midway between these maximum and minimum widths.

   c. If a horizontal linearity problem exists between any two colors, adjust the appropriate horizontal linearity controls (which will probably necessitate readjustments of individual widths) so that all tubes have identical horizontal scans (width and linearity).

   d. Readjust the vertical hold and/or master height controls and the master width control until the pattern overscans the screen corners by approximately one inch on all sides.

5. Blue tube on:

   a. Check that the top and bottom horizontal lines are parallel to the top and bottom screen edges; if not, carefully rerotate the blue yoke until this is so.

   b. Adjust the Blue horizontal keystone control and the blue skew control until the left and right vertical lines are parallel to the left and right screen edges.

6. Red and Blue tubes on:

   a. Match the red and blue center horizontal lines by carefully rerotating the red yoke (if necessary) and by adjusting the blue vertical bow control.

   b. Match the top and bottom red and blue horizontal lines by adjusting the red vertical keystone control and the red individual height control.

   c. Adjust the blue vertical linearity control so that all horizontal red and blue lines simultaneously converge (this may necessitate a readjustment of the blue individual height control).

   d. Match the red and blue center vertical lines by adjusting the red skew control and the horizontal bow control of the color which is bowed farthest to the right at the screen center.

   e. Match the left and right red and blue vertical lines by adjusting the red horizontal keystone control and the red individual width control.

   f. Adjust either the red or blue horizontal linearity control (if necessary) so that all red and blue vertical lines simultaneously converge (this may necessitate a readjustment of the individual width control of the color whose horizontal linearity control was adjusted).

7. Red and Green tubes on:

   a. Match the red and green center horizontal lines by rerotating the green yoke (if necessary) and by adjusting the green vertical bow control.

   b. Match the top and bottom red and green horizontal lines by adjusting the green vertical keystone control and the green individual height control.

   c. Adjust the green vertical linearity control so that all red and green horizontal lines simultaneously converge (this may necessitate a readjustment of the green individual height control).

   d. Match the red and green center vertical lines by adjusting the green skew control and the green horizontal bow control.

   e. Match the left and right red and green vertical lines by adjusting the green horizontal keystone control and the green individual width control.

   f. Adjust either the red or green horizontal linearity control (if necessary) so that all the red and green vertical lines simultaneously converge (this may necessitate a readjustment of the individual width control of the color whose horizontal linearity control was adjusted). If the red horizontal linearity control must be adjusted here, the blue horizontal linearity control will have to be readjusted – see Step 6-f.

The set should now be convergeable over the entire screen (within the width of a line) by using only blue and green DC positioning controls. If not, either make appropriate readjustments or repeat the entire convergence procedure, making readjustments as required.

Pincushion Adjustments

The trim pot and coil on the pincushion board should be adjusted in conjunction with each other for left right symmetry (hump in top vertical line midway across screen) and so that the top horizontal line has a slight upward bow as seen from a standing position.